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A new species of *Smicromorpha* (Hymenoptera, Chalcididae) from Vietnam, with notes on the host association of the genus

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Abstract

Smicromorpha masneri Darling, **sp. n.** is described from Bach Ma National Park, Thua Thien-Hue Province, Vietnam. This is the first confirmed record for the genus on mainland southeast Asia. It is generally accepted that species of *Smicromorpha* are parasitoids of green tree or weaver ants, *Oecophylla smaragdina* (Fabricius) but this is first rearing record of these parasitoids from the nests of weaver ants.

Keywords

Weaver ants, *Oecophylla smaragdina*, Southeast Asia

Introduction

The genus *Smicromorpha* remains "the least known and perhaps the most bizarre subfamily of chalcidid wasps" (Naumann 1986). These wasps – there are currently 6 described species distributed across Southeast Asia – may not even be a subfamily in a phylogenetic system. Based on morphological characters, Wijesekara (1997) argues that Smicomorphinae is not a clade but rather a highly derived genus of Chalcidini

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(Chalcidinae). This hypothesis is certainly not universally accepted (e.g. Bouček 1988) and ongoing molecular studies have yet to clarify the affinities of *Smicromorpha*, but preliminary results suggest they are not members of Chalcidini (John Heraty, pers. comm.). About the best we can do at the present time is regale in the notable features of this enigmatic genus, which includes pale coloration, huge eyes and ocelli, and narrow metasoma inserted high on the propodeum (Figure 1).

The center of species diversity and abundance of the genus is in Australia. It is therefore not surprising that *Smicromorpha* attracted the attention of A.A. Girault, who published information including the description of the genus in five papers between 1913 and 1930. The genus received little attention for the next five decades. *Smicromorpha keralensis* was described from southern India (Narendran 1979), but, as noted by Naumann (1986), the genus was represented in collections by "a handful of specimens, most of which were in poor condition". Extensive collecting along the northern coast of Australia in the 1970s and 1980s dramatically increased the number and the quality of the specimens in Australian collections. This collecting effort resulted in a comprehensive revision of the genus with the description of three new species and illustrations and standardized descriptions of the six species in the genus. The descriptive format in Naumann (1986) was in some ways idiosyncratic for Chalcidoidea, but will be used herein with some modifications for the new species from Vietnam to allow comparisons with the previously described species.

Smicromorpha is generally regarded as an associate of weaver ants in Australia. Naumann (1986), citing Girault (1913), states that *S. doddi* is a parasitoid of the larvae of the green tree or weaver ant (Formicinae). This host association is credited to the noted Australian entomologist F.P. Dodd. Girault (1913) states that "Mr. Dodd informed me that this species is parasitic upon larvae of the green ant, *Oecophylla smaragdina,* depositing eggs upon them when the workers are using their silk-spinning larvae for the purpose of binding the leaves together when building a new nest". F. P. Dodd was a "phenomenal observer" (Geoff Monteith, *in litt.*) and naturalist and spent a great deal of time studying weaver ants (Montieth 1991). There are also reports of *Smicromorpha* hovering near nests of *O. smaragdina* (Naumann 1986:176 for *S. minera*, Narendran 1979:201 for *S. keralensis* and Geoff Monteith, *in litt.*). Strong circumstantial evidence for this host association comes from the geographic distributions of *Smicromorpha* and *Oecophylla* in Australia. Naumann (1986) illustrated the concordance of their distribution maps in northern Australia (his fig. 2). However, this host association is still regarded as anecdotal.

Naumann (1986) further states that specimens have not been reared from weaver ant nests and Bouček (1980) notes that this host association has not been confirmed.

Given the broadly overlapping distributions of *Smicromorpha* and weaver ants in Australia and India, it is somewhat surprising that *Smicromorpha* has not been recorded from mainland southeast Asia. *Oecophylla smaragdina* ranges from southern India across almost all of tropical Asia (Hölldobler 1983) and north to southern China. The only literature report of *Smicromorpha* for mainland southeast Asia is an undescribed species (and genus?) from Singapore (Bouček 1988).

In this paper I describe a new species that confirms the presence of *Smicromorpha* on mainland southeast Asia, and provide rearing information which strongly suggests that weaver ants (*Oecophylla*) are the hosts of these parasitoids.

Materials and methods

The format of the description follows Naumann (1986) to permit comparison with the standardized descriptions of the previously described species, with a few exceptions. Naumanns's terms for the carinae on the mesopleuron are not used (e.g., sternalus, omaulus); these are not generally used for descriptive purposes in Chalcidoidea. Terms not discussed in Naumann (1986) follow Gibson (1997). The clava, as Naumann notes is "unsegmented, hardly differentiated" and the flagellar segments are herein simply numbered; in females F7 is the clava (sensu Naumann). Measurements also follow Naumann (1986). The new species is most similar to *S. lagynos* Naumann (see below) and specific side-by-side comparisons were made with a paratype female: Australia, Northern Territory, Bramston Beach, near Innisfail, 30.IV.1967, D.H. Colless, open savannah (ANIC Database No. 32 004729). Unless noted in the description, the characters agree with *S. lagynos* based on both this paratype and the original description. The only additional character added to the description was the dorsal carina on the petiole (Fig. 10, dc). Identified specimens of the following species were examined to understand alternative character states (all ANIC): *S. doddi, S. banksi, S. minera and S. keralensis*.

Type material will be deposited at the Royal Ontario Museum, Toronto, Canada (ROME) and the Institute for Ecology and Biological Resources, Hanoi, Vietnam (IEBR). Amplified DNA from paratype female #1 is deposited at the University of California, Riverside (UCR: contact, John Heraty). Comparative material, which formed the basis of Naumann's (1986) revision of the genus, was obtained on loan from the Australian National Insect Collection, Canberra, Australia (ANIC).

Smicromorpha masneri Darling, sp. n.

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Figs 1–3, 5, 9

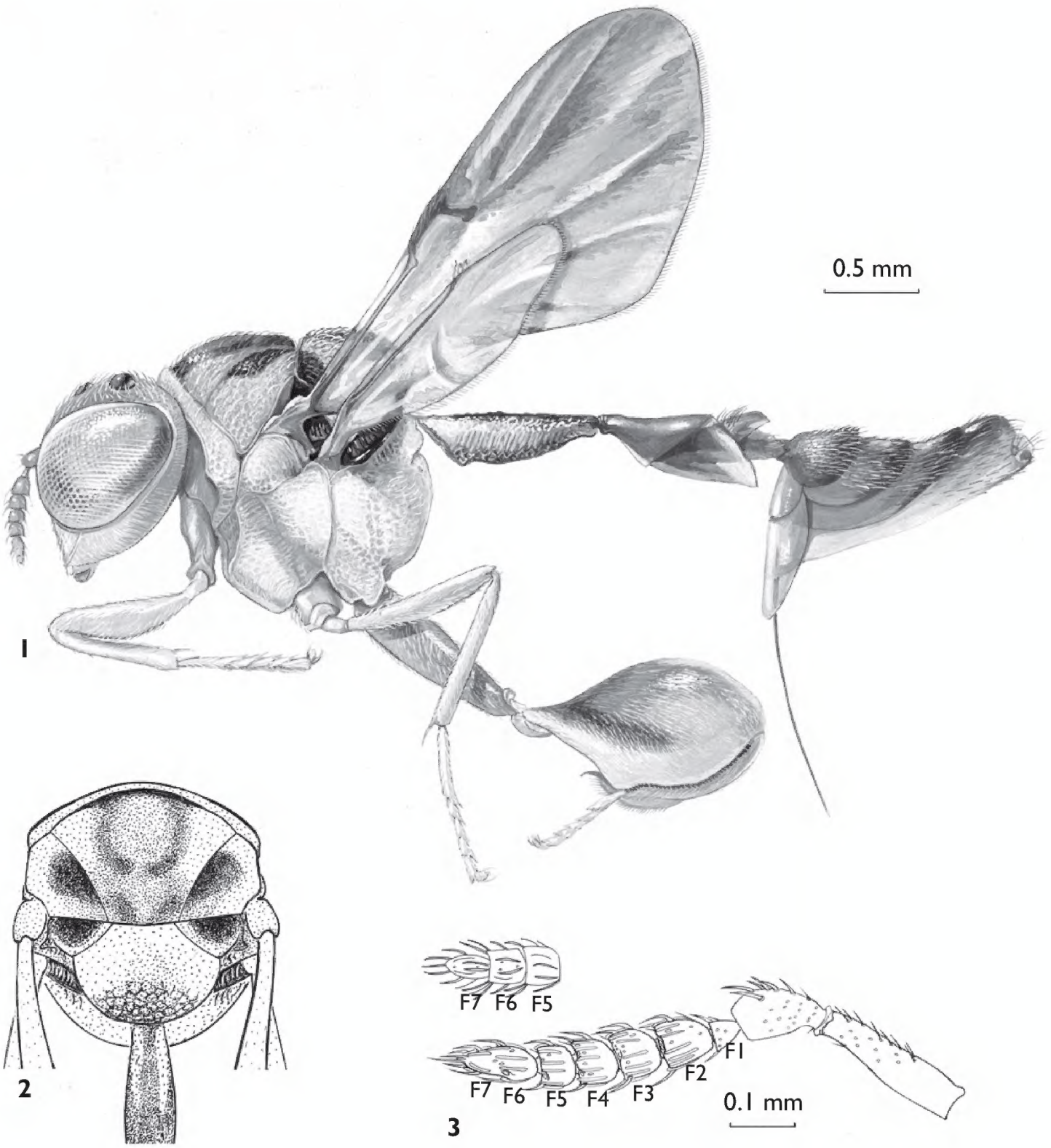
Description. The complete description is the detailed subfamily description in Naumann (1969) (= description of *Smicromorpha* Girault, *sensu* Naumann, 1986), augmented with the measurements and characters which follow below.

Female (n=4). Body length: 4.2–5.1mm. Forewing length: 2.3–2.6 mm.

Colour (Figures 1 and 2): Predominantly pale yellow to white, darker dorsad. Mesoscutum with light brown areas, a diffuse circle on midlobe of mesoscutum and along transscutal articulation, and dark brown along notauli. Axilla and lateral panel of axilla dark brown to black. Apex of scutellum light brown. Lateral panel of metanotum dark brown. Propodeum white. Fore and mid legs white, hind legs dark yellow dorsad,

white below, femoral teeth black, tibia yellow, tarsus white. Metasoma brown, darker above, petiole dark brown but yellow-white basad. Antenna yellow. Forewing hyaline, darker on disc and along setal lines. Pubescence: Head, mesosoma, hind femur with short, appressed setae. Flagellar setae moderately long, suberect.

Head: In frontal view transverse, wider than high, width/height approx. 1.4. In dorsal view, subquadrate, wider than long, width/length 1.7–2.3. Compound eye moderately large. Ocelli moderately large, POL/OOL 0.7–0.9, OD/OOL approx. 0.7, OS greater than OD, frons between median ocellus and scrobes with



Figures 1–3. *Smicromorpha masneri* sp. n., holotype female: **1** lateral habitus **2** mesosoma dorsal view **3** antenna – inset, apical flagellomeres, paratype #1, female, right antenna.

weak longitudinal groove. Malar sulcus (subocular suture *sensu* Naumann) indistinct (distinct in *S. lagynos*), M/MAE 0.3–0.4. Antennal scrobes deep, carinate, lateral margin widely separated from compound eye, SW/FW approximately 0.5, UF/LF 2.6–3.2. Vertex and upper frons minutely coriarious (weaker than *S. lagynos*, reticulate-punctate *sensu* Naumann), lower frons and clypeus weakly striate, anterior tentorial pits large and distinct (indistinct in *S. lagynos*). Antenna (Fig. 3): F1, F2 1.1–1.3, 1.1–1.5 × as long as wide, respectively. F1 0.5–0.7 × as long as F2. F6 and F7 either fused or separate (Fig. 3; see also Variation section), if F6 and F7 separate, F7 subequal or shorter than F6 (longer in *S. lagynos*, as in Naumann 1986, his fig, 6). Flagellum fusiform.

Mesosoma: Pronotal collar laterally carinate. Mesopleural sutures as in *S. lagynos*. Upper mesopleuron rugose-punctate, mesopleural depression weakly strigose (cf. strongly strigose in *S. lagynos*), ventral mesopleuron transverse-strigose. Propodeum posteriorly convex; spiracular sulcus indistinct. Hind leg: coxa 3.5–4.1 × as long as high. Femur 1.7–2.0 × as long as high, with a weak ventral process and well-developed comb of fine teeth. Tibia slender, dorsal furrow about 0.25 as long as tibia (cf. longer in *S. lagynos*, 0.3–0.6 as long as tibia). Apical tarsal segment slender. Forewing: shape normal. Stigmal vein shorter than marginal vein; angle between stigmal and marginal veins slightly obtuse. Stump of basalis present.

Petiole: Length/width approximately 3.5, length/height 3.6–4.1 (Figs. 5, 9). Dorsally minutely reticulate-punctate, without paired dorsal carinae (Fig. 9, cf. Fig. 10, *S. lagynos*); transverse lamina indistinct, not extending posteroventrally to midlength of petiole; lateral margins not distinctly carinate in posterior 0.5.

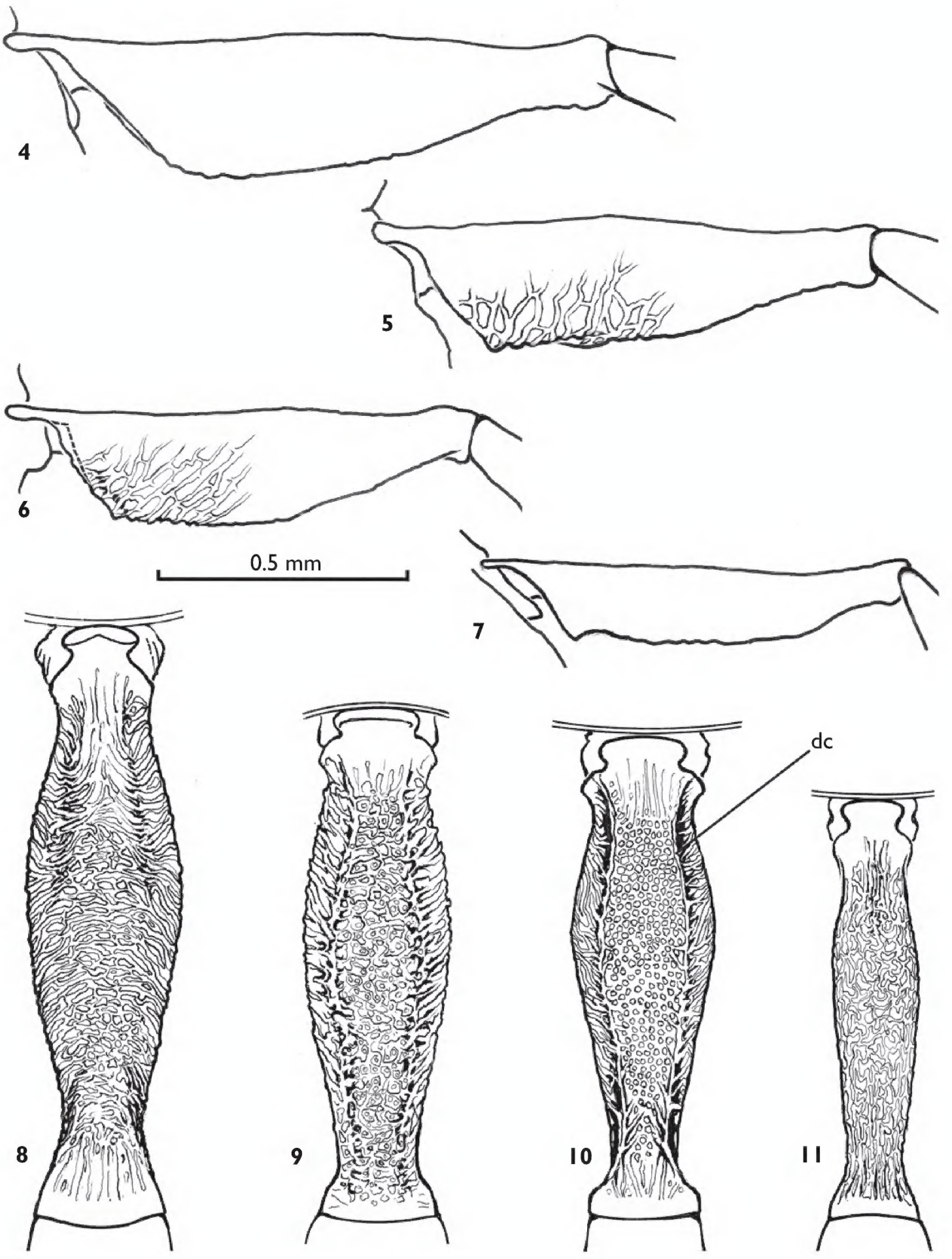
Male. Unknown.

Etymology. The species epithet is a patronym commemorating Dr. Lubomír Masner's 75th birthday.

Type material. Holotype**:** Female. VIETNAM: Thua Thien-Hue Province, Bach Ma National Park, secondary forest. Ex: nest of *Oecophylla smaragdina*. 16°15'1"N, 107°52'24"E, 26m. June 27, 2000. Reared at Toronto Zoo, August 9–13, 2000. T. Mason and L. Attard. DC Darling Slide 2067 (antenna). (point-mounted, ROME)

Paratypes: Females (n=3, ROME, IEBR), all same data as holotype. 1. Card-mounted, missing right hind leg, DNA voucher UCR, D2651 (ROME). 2. Card-mounted, right forewing and hindwing on separate point, left femur, tibia and tarsus missing (ROME). 3.Card-mounted (IEBR).

Diagnosis. This species is most similar to *S. lagynos* and will run to that species in the key of Naumann (1986). Differences noted in the description above are diagnostic with respect to *S. lagynos*. *Smicromorpha masneri* is most easily distinguished from other species of the genus by the shape and sculpture of the petiole (Figs. 4–11) in combination with the size of the transverse lamina at the base of the petiole (Naumann 1986, his figs. 22, 24). *Smicromorpha masneri* does not have the strong paired dorsal carinae at the base of the petiole characteristic of *S. lagynos* (Fig. 10). In addition, *S. masneri* has distinct tentorial pits, which are absent in *S. lagynos*. Females of each of the other described species of the *Smicromorpha* have



Figures 4–11. *Smicromorpha* female petiole. **4–7** lateral view: **4** *S. keralensis* **5** *S. masneri* sp. n. **6** *S. lagynos* **7** *S. banksi*. **8–11** dorsal view: **8** *S. keralensis* **9** *S. masneri* sp. n. **10** *S. lagynos* **11** *S. banksi*. dc, dorsal carina.

diagnostic characters not found in *S. masneri* (see descriptions, illustrations and key in Naumann 1986).

The key in Naumann (1986) can be modified to accommodate *S. masneri* as follows:

5	Petiole of female ventrally distinctly swollen, less than 3.7 × as long as high, transverse lamina indistinct; antennal clava longer than wide; F1 of female less than 0.7 × as long as F2 ..... **6**
-	Petiole of female ventrally not distinctly swollen, more than 4.0 × as long as high; transverse lamina distinct; antennal clava wider than long; F1 of female 0.8 × as long as F2 ..... ***S. banksi* Naumann**
6	Strong paired dorsal carinae present at the base of the petiole (Fig. 10); tentorial pits absent..... ***S. lagynos* Naumann**
-	Paired dorsal carinae at the base of petiole absent (Fig. 9); tentorial pits distinct..... ***S. masneri* sp. n.**

Variation. There is variation in the segmentation of the antenna in the type series of *S. masneri,* specifically concerning the apical flagellomeres. In the holotype, the left antenna is collapsed and the right is slide-mounted. Figure 3 illustrates the right antenna and F6 and F7 are at least partially fused and the differentiation between the articles is most evident by the placement of the multiporus plate sensilla. This fusion of F6 and F7 is also evident in the paratypes but only for the left antennae (paratypes #2 and #3). In paratype #1(both antennae) and paratypes #2 and #3 (both right), F6 and F7 are distinctly separated and F7 is the same length as F6 and only slightly narrower than F6 (Fig. 3, inset). The significance and occurrence of this variation in other species cannot be evaluated at this time. Naumann (1986) was uncharacteristically non-committal about the antennae of females and did not present relative measurements of F6 and F7 (his "clava") and only illustrated the female antenna of a single species. My notes taken at the ANIC in March 2001 indicate that similar variation occurs in other species of the genus but a much more comprehensive study would be required to fully document and understand this variability. I present these comments primarily as an explanation for Figure 3 and so that future workers will not suffer the anxiety that I have had while trying to reconcile the antennal structure under an assumption of bilateral symmetry.

Notwithstanding the above, the size of the clava and distal flagellar segment (e.g., F6) does appear to have diagnostic value for males and females of the genus (Naumann 1986, his figs. 3–7). For example, when differentiated from F6, the F7 of *S. masneri* is distinctly shorter than F7 of *S. lagynos*, relative to F6.

Biology and rearing notes. The type material of *Smicromorpha masneri* was obtained by rearing nest pods of *Oecophylla smaragdina* in a greenhouse where there was no possibility of contamination. The weaver ant nest pods were attached to citrus trees obtained from a local nursery. These trees were examined for possible contamination (e.g., scale insects and aphids) prior to use and the ants and their host trees were the only occupants of the greenhouse. This confirms that these wasps are associated with

the *Oecophylla smaragdina* and that in all likelihood these wasps are primary parasitoids of weaver ants.

Two nest pods – arboreal nest fragments made of leaves and held together with silk from the third-instar ant larvae – were collected at Bach Ma National Park on July 27, 2000 and transported by air in double-sealed containers to Toronto, Canada. The containers were delivered to Tom Mason and Lydia Attard at the Toronto Zoo on July 1; on arrival one nest pod contained only dead ants and the other was assigned #35747. By July 5 new pods were being constructed by the ants and on August 9 Tom Mason observed and later collected a small insect flying in front of one of the new weaver ant pods – the specimen was sent to me for identification. On August 13, three more specimens were caught hovering in the vicinity of the weaver ant pods. These four specimens comprise the type series of *S. masneri.* Given that the parasitoids were associated with a weaver ant nest in a secure indoor facility and far outside its normal range it is virtually certain that the wasps emerged from the ant nest that was transported to Toronto – and that the type locality is properly indicated as Vietnam. The ant colony survived at the Toronto Zoo for almost a year but no additional *Smicromorpha* were observed. It is curious that no males were collected but males wouldn't necessarily be expected hovering around the weaver ant pods, unless they were searching for mating opportunities.

Discussion

Weaver ants are most vulnerable to predators and parasitoids that are active outside the nest when workers use the final-instar larvae for nest pod construction and repair. The larvae are brought outside the nest pod in the mandibles of the workers and moved back and forth while producing silk to fasten the leaves together (Hölldobler and Wilson 1990, Plate 24). In Thailand, the larvae are rarely used for external weaving during the daytime, but this activity increases at night (Hemmingsen, 1973). This helps explain unusual aspects of both the behaviour and morphology of *Smicromorpha.* Naumann (1986) notes that at least 4 of the 5 previously described species are attracted to light and are probably nocturnal, which is unusual for Chalcidoidea. Many of the distinctive morphological features of these wasps, including the large eyes and ocelli, light non-metallic body color (the so-called "ophionoid facies", Gauld and Huddleston 1976), and extremely slender and apparently mobile gaster, are consistent with a highly specialized nocturnal parasitoid lifestyle.

Acknowledgements

This paper is dedicated to Lubomír Masner on the occasion of his 75th birthday. He continues to be an inspiration to students of the Hymenoptera and if one's motivation is flagging, all that is needed is a trip to visit Lubo and to spend an hour with him

"talking hyms". In the long term, his greatest legacy will probably be overlooked. In my opinion, this will not be the excellent Hymenoptera collection in the Canadian National Insect Collection in Ottawa, or the specimens of "proctos" he has identified and distributed to many museums worldwide. His legacy will be the specimens of all groups of insects, collected in all parts of the world, by field biologists who have fallen under his spell! These specimens, many of them from habitats that no longer remain in their pristine form, and languishing in freezers and in the deepest reaches of collections, will continue to throw light on the diversity of life on earth for the foreseeable future. The discovery of this new species was facilitated in part by a Discover Grant from the Natural Sciences and Engineering Council of Canada (NSERC). The impetus to collect the weaver ant colonies came from Tom Mason and Lydia Attard (Toronto Zoo) and the collections were made by Brad Hubley. Antonia Guidotti assisted with the manuscript and the illustrations were prepared by Patrice Stephens-Bourgeault.

References

Bouček Z (1988) Australasian Chalcidoidea (Hymenoptera). A biosystematic revision of genera of fourteen families, with a reclassification of species. C.A.B. International, Wallingford, England. 832 pp.

Gauld ID, Huddleston T (1976) The nocturnal Ichneumonoidea of the British Isles, including a key to genera. Entomologists Gazette 27: 35–49.

Gibson GAP (1997) Morphology and Terminology. In: Gibson APG, Huber JT, Woolley JB (Eds) Annotated Keys to the Genera of Nearctic Chalcidoidea (Hymenoptera). NRC Research Press, Ottawa, Canada.

Girault AA (1913) Some chalcidoid Hymenoptera from Northern Queensland. Archiv für Naturgeschichte 79: 70–90.

Hemmingsen AM (1973) Nocturnal weaving on nest surface and division of labour in weaver ants (*Oecophylla smaragdina* Fabricius, 1775). Videnskabelige Meddelelser fra Dansk Naturehistorisk Forening 136:49–59 (original not seen, cited in Hölldobler and Wilson, 1990).

Hölldobler B (1983) Territorial behavior in the green tree ant (*Oecophylla smaragdina*). Biotropica 15: 241–250.

Hölldobler B, Wilson EO (1990) The Ants. Harvard University Press, Cambridge, MA, USA.

Monteith, G. (1991) The Butterfly man of Kuranda – Frederick Parkhurst Dodd. Queeensland Museum, Brisbane, Australia.

Narendran TC (1979) A new species and a new record of the interesting genus *Smicromorpha* Girault (Hymenoptera: Chalcididae) from Oriental region. Journal of Bombay Natural History Society 75: 908–911.

Naumann ID (1986) A revision of the Indo-Australian Smicromorphinae (Hymenoptera: Chalcididae). Memoirs of the Queensland Museum 22: 169–187.

Wijesekara GAW (1997) Phylogeny of Chalcididae (Insecta: Hymenoptera) and its congruence with contemporary hierarchical classification. Contributions of the American Entomological Institute 29: 1–61.